

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

In the Matter of	)	
	)	
Sirius XM Radio Inc.	)	
	)	
Application for Authority to Launch and Operate	)	File No. SAT-RPL-_____
SDARS Replacement Spacecraft at 85.15° W.L.	)	
	)	
Application for Authority to Launch and Operate	)	File No. SAT-RPL-_____
SDARS Replacement Spacecraft at 115.25° W.L.	)	

APPLICATION OF SIRIUS XM RADIO INC.

Sirius XM Radio Inc. (“Sirius XM”) hereby applies for authority under the Communications Act of 1934, as amended, and the Federal Communications Commission’s regulations thereunder, to launch and operate two technically identical satellite digital audio radio service (“SDARS”) replacement satellites, designated SXM-9 and SXM-10. Specifically, Sirius XM requests: (1) authority to launch and operate SXM-9, which is intended to replace XM-5 at 115.25° W.L. +/- 0.1 degrees; (2) authority to launch and operate SXM-10, which is intended to replace XM-3 at 85.15° W.L. +/- 0.1 degrees; and (3) the flexibility to position and operate SXM-9 and SXM-10 at any of the Sirius XM orbit locations, 85.15° W.L., 86.15° W.L., 115.25° W.L., and 116.15° W.L., as needed to meet SDARS service requirements. Granting this application will serve the public interest by facilitating Sirius XM’s ability to provide continuous, reliable service to tens of millions of SDARS subscribers and other users.

Pursuant to Section 25.114 of the Commission’s rules, Sirius XM is attaching a technical narrative that describes the SXM-9 and SXM-10 spacecraft. In addition, a completed FCC Form 312 and a location-specific Schedule S is attached for each satellite.

I. BACKGROUND

Sirius XM provides a full range of audio programming, including music, news, sports, weather, and traffic, to more than 32 million U.S. customers. This content is transmitted to users over a fleet of geostationary orbit (“GSO”) spacecraft at four orbital locations: SXM-8 at 85.15° W.L., FM-5 at 86.15° W.L., XM-5 at 115.25° W.L., and FM-6 at 116.15° W.L. Back-up capacity for these four primary space stations is provided by the XM-3 in-orbit spare satellite, which flies in formation with SXM-8 at 85.15° W.L. The SXM-7 satellite also provides limited in-orbit spare capacity¹ and flies in formation with SXM-8 and XM-3 at 85.15° W.L.

In order to ensure continuity of service to its customers, Sirius XM has entered into contracts to build and launch two next-generation satellites, SXM-9 and SXM-10. Sirius XM proposes to operate SXM-9 at 115.25° W.L. and SXM-10 at 85.15° W.L., but the two satellites are technically identical and each is capable of operating at any of the Sirius XM orbit locations, 85.15° W.L., 86.15° W.L., 115.25° W.L. and 116.15° W.L. Sirius XM currently plans to launch SXM-9 in mid-2024 with operations commencing later in the year, and plans to launch SXM-10 and commence operations in 2025.

The SXM-9 and SXM-10 satellites have primary downlink frequencies in the 2320-2345 MHz SDARS band and will receive uplink transmissions in the 7025-7075 MHz band designated for SDARS feeder links. The SXM-9 and SXM-10 satellites are also capable of downlinking at frequencies in the Wireless Communications Service (“WCS”) spectrum immediately adjacent to the SDARS band, 2315-2320 MHz (“C Block”) and 2345-2350 MHz (“D Block”). Sirius XM is not seeking licensing authority in the WCS C Block and D Block

¹ See Letter of Karis Hastings, outside counsel for Sirius XM, to Marlene H. Dortch, Call Sign S3033, File No. SAT-RPL-20180430-00033, dated Apr. 1, 2021 at 1 (noting that certain SXM-7 payload units failed during in-orbit testing of the satellite).

spectrum at this time but has included these bands in the attached technical materials for the Commission's information.

During normal operations, TT&C will also be performed in the SDARS frequency bands. The satellites are capable of receiving command signals anywhere within the 7025-7075 MHz band, and Sirius XM seeks the flexibility to select specific command frequencies within that range. Grant of the requested flexibility will serve the public interest and is consistent with Commission precedent. The SXM-9 and SXM-10 satellites will be positioned at the same nominal orbital location as other Sirius XM spacecraft upon deployment, and over the course of the satellites' life, the other spacecraft with which SXM-9 and SXM-10 are sharing a location may change. Allowing Sirius XM to adjust its command frequencies within the specified ranges will enhance Sirius XM's ability to communicate with and control SXM-9 and SXM-10 and facilitate collocation of these spacecraft with different satellites during their mission lifetimes. The Commission has previously authorized TT&C operations over a much wider range to make collocation with other satellites easier,² and granting Sirius XM the requested flexibility for SXM-9 and SXM-10 will serve a similar function.

Sirius XM also seeks authority to perform TT&C during initial orbit raising for the satellites using C-band frequencies: 4196-4198.5 MHz (Space-to-Earth) and 6422-6425 MHz (Earth-to-Space). As discussed below, this limited use of C-band spectrum for TT&C will help ensure safe operation of the satellites prior to placement at their assigned locations.

² See, e.g., *Space Logistics, LLC*, Call Sign S2990, File Nos. SAT-LOA-20170224-00021 & SAT-AMD-20190207-00008, granted June 20, 2019, Attachment to Grant at 1 & n.3 (permitting TT&C operations for Mission Extension Vehicle-1 across the full range of C-band and Ku-band frequencies on the satellite subject to coordination).

The primary mission for the SXM-9 and SXM-10 satellites is to serve as replacements for the XM-5 satellite at 115.25° W.L. and for the XM-3 in-orbit spare spacecraft at 85.15° W.L., respectively, but the satellites may also be used to provide back-up capacity for other satellites in the Sirius XM fleet. Ensuring robust, continuous SDARS service may require Sirius XM to position SXM-9 or SXM-10 at any of the Sirius XM orbit locations, 85.15° W.L., 86.15° W.L., 115.25° W.L. and 116.15° W.L. Sirius XM requests herein the authority to perform such relocations without the need for a prior modification application.

II. AUTHORIZING SXM-9 AND SXM-10 WILL SERVE THE PUBLIC INTEREST AND IS CONSISTENT WITH COMMISSION PRECEDENT

Grant of the requested authority for Sirius XM to launch, operate, and position SXM-9 and SXM-10 will serve the public interest by ensuring Sirius XM's ability to provide service continuity and is fully consistent with Commission precedent.

The Commission has repeatedly recognized that satellite radio offers enormous public interest benefits for the American public.³ The Commission has observed that satellite radio is unique in its ability to provide nationwide programming, including to the most rural and remote

³ See, e.g., *Establishment of Rules and Policies for the Digital Audio Radio Satellite Service*, Report and Order, Memorandum Opinion and Order, and Further Notice of Proposed Rulemaking, 12 FCC Rcd 5754 (1997) at ¶ 1.

parts of the country that are often underserved by terrestrial radio.⁴ Moreover, the Commission has concluded that satellite radio can offer niche programming to listeners with special interests.⁵

Sirius XM now provides high-quality, continuous digital multi-channel audio service to more than 32 million subscribers, from downtown urban cores to rural and remote parts of the United States, serving multiple niche programming interests. SDARS signals also play a critical public safety role during natural disasters and emergencies when terrestrial communications networks may be unavailable. Specifically, Sirius XM has used its network to disseminate emergency alerts and to make available critical weather information, not just to subscribers, but also to unsubscribed radios, reaching over 150 million SDARS satellite radios. By launching and operating next-generation satellites, Sirius XM will ensure its ability to continue providing these and other important services.

The Commission has expressly recognized a replacement expectancy for GSO satellite operators:

Given the huge costs of building and operating GSO space stations, we have found that there should be some assurance that operators will be able to continue to serve their customers. Therefore, the Commission has stated that, when an orbit location remains available for a U.S.

⁴ *Id.* at ¶ 12 (“It is our view that satellite DARS will particularly benefit communities where terrestrial broadcast service is less abundant. The record shows that counties with smaller populations have fewer radio stations and that smaller markets have fewer radio formats.”) (footnote omitted); ¶ 13 (“With its national reach, satellite DARS could provide continuous radio service to the long-distance motoring public [and] persons living in remote areas”) (footnote omitted); ¶ 90 (“applicants have proposed new choices in audio programming which may be beneficial for the mobile public and for unserved and underserved communities, particularly in rural or remote areas.”).

⁵ *Id.* at ¶ 14 (“Satellite DARS may also be able to foster niche programming because it can aggregate small, nationally dispersed listener groups that local radio could not profitably serve.”) (footnote omitted). *See also Applications for Consent to the Transfer of Control of Licenses, XM Satellite Radio Holdings Inc., Transferor, to Sirius Satellite Radio Inc., Transferee*, Memorandum Opinion and Order, 25 FCC Rcd 14779 (2010) (implementing Sirius XM’s voluntary merger commitment to lease a portion of its channel capacity to Qualified Entities).

satellite with the technical characteristics of the proposed replacement satellite, it will generally authorize the replacement satellite at the same location.⁶

The Commission has also made clear that a replacement satellite need not be identical to the current spacecraft:

We do not require replacement satellites to be technically *identical* to the existing satellite. We recognize that next-generation satellites will incorporate satellites with technical advancements made since the previous generation satellite was launched. We do not intend to change this policy, which facilitates state-of-the-art systems. Rather, we will continue to assess only whether operations of the replacement satellite will be consistent with our international coordination obligations pursuant to regulations promulgated by the International Telecommunication Union.⁷

As discussed above, Sirius XM currently provides SDARS using satellites at 85.15° W.L. and 115.25° W.L., giving Sirius XM a replacement expectancy for SDARS operations at these orbital locations. The frequencies remain available for use by Sirius XM, and operation of SXM-9 and SXM-10 will conform to the Commission's international coordination obligations. Deploying SXM-9 and SXM-10 as requested herein will allow Sirius XM to use state-of-the-art satellites to ensure long-term continuity of service for SDARS customers. This is exactly the result the Commission's long-standing replacement expectancy policy is designed to achieve.

Allowing Sirius XM to position the SXM-9 and SXM-10 satellites at any of the Sirius XM orbit locations – 85.15° W.L., 86.15° W.L., 115.25° W.L., and 116.15° W.L. – will also

⁶ *Amendment of the Commission's Space Station Licensing Rules and Policies*, First Report and Order and Further Notice of Proposed Rulemaking, 18 FCC Rcd 10760, 10854-55 (2003) (footnotes omitted). More recently, the Commission codified its processing policy with respect to replacement satellites in Section 25.158(a)(2), which exempts replacement spacecraft from the filing queue otherwise applicable to new space station applications.

⁷ See *id.* at 10857 (emphasis in original; footnotes omitted).

serve the public interest. This flexibility will enhance Sirius XM's ability to deploy its satellite assets as needed to ensure service continuity. Moreover, because the two spacecraft are technically identical, the operating parameters at any orbital location will be consistent with other Sirius XM licenses for that location, regardless of which satellite is positioned at a given location.

III. THE COMMISSION SHOULD GRANT ANY NECESSARY RULE WAIVERS FOR SXM-9 AND SXM-10

Sirius XM seeks limited waivers of the Commission's rules in connection with this application for the SXM-9 and SXM-10 replacement satellites. Granting these requested waivers is consistent with Commission policy:

The Commission may waive a rule for good cause shown. Waiver is appropriate if special circumstances warrant a deviation from the general rule and such deviation would better serve the public interest than would strict adherence to the general rule. Generally, the Commission may grant a waiver of its rules in a particular case if the relief requested would not undermine the policy objective of the rule in question and would otherwise serve the public interest.⁸

SXM-9 and SXM-10 substantially comply with the Commission's rules, but certain waivers are appropriate given the scope of the authority requested, the frequencies to be used, and the planned spacecraft operating parameters as described herein. Because SXM-9 and SXM-10 will allow Sirius XM to continue to provide high-quality SDARS programming to tens of millions of users, granting the requested waivers will serve the public interest.

Section 25.118(e): Sirius XM requests any necessary waiver of Section 25.118(e) to allow the SXM-9 and SXM-10 satellites to be positioned or repositioned and operated at any of the Sirius XM orbit locations, 85.15° W.L., 86.15° W.L., 115.25° W.L. and 116.15° W.L. Grant

⁸ *PanAmSat Licensee Corp.*, 17 FCC Rcd 10483, 10492 (Sat. Div. 2002) (footnotes omitted).

of such a waiver is consistent with the purpose of this rule, which is to facilitate the relocation of satellites among orbital locations assigned to a licensee, provided that such moves do not increase the satellites' interference potential.⁹ Sirius XM requested and was granted a similar waiver to allow its SXM-7 and SXM-8 satellites to be positioned at either of the 85.15° W.L. or 115.25° W.L. locations.¹⁰

Under the Section 25.118(e) framework, a geostationary satellite operator may reposition satellites without prior Commission approval subject to specified requirements, including providing 30 days' notice and submitting certain certifications. Specifically, the rule states in pertinent part that:

(e) *Relocation of GSO space stations.* A space station licensee may relocate a GSO space station without prior authorization, but upon 30 days prior notice to the Commission and any potentially affected licensed spectrum user, provided that the operator meets the following requirements. The notification must be filed electronically on FCC Form 312 through the International Bureau Filing System (IBFS) in accordance with the applicable provisions of part 1, subpart Y of this chapter:

- (1) The space station will be relocated to a position within $\pm 0.15^\circ$ of an orbital location assigned to the same licensee.
- (2) The licensee certifies that the space station will operate after the relocation within the technical parameters authorized and coordinated for the space station previously assigned to that location.
- (3) The licensee certifies that it will comply with all the conditions of its license for operation at the changed location.
- (4) The licensee certifies that it will limit operations of the space station to tracking, telemetry, and command functions during the relocation and satellite drift transition period.

⁹ *Amendment of the Commission's Space Station Licensing Rules and Policies*, Second Report and Order, 18 FCC Rcd 12507 (2003) ("Second Space Station Reform Order") at 12509, ¶ 7.

¹⁰ See *Sirius XM Radio Inc.*, Call Sign S3033, File No. SAT-RPL-20180430-00033, granted Oct. 3, 2018 ("SXM-7 Grant"), Attachment to Grant at 3, ¶ 12; *Sirius XM Radio Inc.*, Call Sign S3034, File No. SAT-RPL-20180430-00034, granted Oct. 3, 2018, Attachment to Grant at 3, ¶ 12.

(5) The licensee certifies that:

(i) It has assessed and limited the probability of the satellite becoming a source of debris as a result of collisions with large debris or other operational satellites at the new orbital location; and

(ii) The proposed station-keeping volume of the satellite following relocation will not overlap a station-keeping volume reasonably expected to be occupied by any other satellite, including those authorized by the Commission, applied for and pending before the Commission, or otherwise the subject of an ITU filing and either in orbit or progressing towards launch.

(6) The licensee certifies that the relocation will not result in a lapse of service for any current customer.¹¹

Consistent with subsections (1), (2), and (3) of Section 25.118(e), Sirius XM is seeking authority to position the SXM-9 and SXM-10 satellites at any of the Sirius XM orbit locations – 85.15° W.L., 86.15° W.L., 115.25° W.L., and 116.15° W.L. – subject to all the technical parameters and license terms and conditions associated with each orbital position. Because the satellites are technically identical, the operating characteristics at these locations will be the same without regard to whether the spacecraft operating at a given orbital slot is SXM-9 or SXM-10. The requirements in subsection (5) of the rule are met as well: the orbital debris mitigation showing provided in the technical appendix to this application is not dependent on the specific orbital location at which SXM-9 or SXM-10 is operating, and any overlap of the stationkeeping volume at either orbital slot would involve only other satellites operated by Sirius XM. Moreover, Sirius XM would reposition SXM-9 or SXM-10 solely to ensure service continuity, consistent with the mandate of subsection (6) of the rule.

¹¹ 47 C.F.R. § 25.118(e). The final two provisions of the rule, subsections (7) and (8), are limited to DBS spacecraft, and thus are not applicable to the SDARS satellites at issue here.

The authority Sirius XM requests requires waiving the provisions of Section 25.118(e) in two respects. First, rather than providing 30 days' notice to the Commission prior to any relocation of SXM-9 or SXM-10, Sirius XM seeks advance authority to position or reposition each satellite subject only to a requirement to notify the Commission within two business days after commencing a move. Second, Sirius XM requests a waiver of subsection (4) of the rule to allow SDARS operations, not just TT&C functions, during any satellite relocation. The Commission granted Sirius XM comparable rule waivers for SXM-7 and SXM-8.

The requested departures from the Commission's typical requirements are justified under the specific circumstances here. As noted above, Sirius XM is the sole licensee in the SDARS frequency bands, having purchased the right to use the spectrum at auction, and the 85.15° W.L., 86.15° W.L., 115.25° W.L., and 116.15° W.L. orbital locations are already assigned to Sirius XM.¹² As a result, positioning SXM-9 or SXM-10 at any of these orbital locations, and operating the satellite's SDARS payload during the drift, would not create interference issues affecting other satellite operators.¹³ As the Commission determined in granting similar waivers for SXM-7 and SXM-8, permitting "Sirius XM to manage its spacecraft as needed will facilitate service continuity for SDARS subscribers."¹⁴

The same rationale supports grant of a waiver here. Affording Sirius XM the requested flexibility is fully consistent with the purpose underlying the Section 25.118(e) fleet management provision. In adopting the rule, the Commission observed that:

Establishing a streamlined procedure for satellite fleet management modifications . . . would expedite grant of modification applications that do not involve increased

¹² See, e.g., SXM-7 Grant, Attachment to Grant at 3, ¶ 12(a).

¹³ *Id.* at 3, ¶ 12(b).

¹⁴ *Id.* at 3, ¶ 12(c).

interference potential. We have previously allowed satellite operators to rearrange satellites in their fleet to reflect business and customer considerations where no other public interest factors are adversely affected. Moreover, such a streamlined procedure would facilitate satellite operators' efforts to meet the service needs of their customers. Further, by devoting fewer administrative resources to satellite fleet management modification requests, we can direct more attention to other pending applications.¹⁵

Granting the requested repositioning flexibility for SXM-9 and SXM-10 will promote these goals by allowing Sirius XM to efficiently manage its fleet while minimizing unnecessary administrative burdens on the Commission and its staff. Because no other party is authorized to use SDARS spectrum, enforcing the full requirements in Section 25.118(e), including the advance notification obligation and the restriction to TT&C operations during drift, is not needed to prevent interference. Moreover, the Commission has previously authorized SDARS operations during satellite drift to enable the provision of uninterrupted service, allowing FM-5's communications payload to remain active as the satellite was relocated from 96° W.L. to 86.15° W.L.¹⁶

The authority Sirius XM seeks to position SXM-9 and SXM-10 is fully consistent with the purpose of Section 25.118(e), with the public interest in continuity of SDARS service, and with Commission precedent. Accordingly, the Commission should grant limited waivers of the Section 25.118(e) requirements to allow Sirius XM the flexibility to deploy its satellites as

¹⁵ Second Space Station Reform Order, 18 FCC Rcd at 12509-12510, ¶ 7 (footnotes omitted).

¹⁶ See *Sirius XM Radio Inc.*, Call Sign S2710, File No. SAT-MOD-20151211-00081, granted Feb. 25, 2016. See also *XM Radio, Inc.*, Call Sign S2616, File No. SAT-MOD-20100722-00165, granted Oct. 14, 2010 (authorizing SDARS operations during drift of XM-4 satellite from 115° W.L. to 115.25° W.L.).

needed at any of the Sirius XM orbital locations and to provide SDARS service during any relocations.

Section 25.202(g): Sirius XM requests any necessary waiver of the requirements of Section 25.202(g) of the Commission's rules relating to performing telemetry, tracking and command ("TT&C") within the bands assigned for satellite operations.¹⁷ The Commission has explained that:

The purpose of this rule is to simplify the coordination process for satellite systems, to provide an incentive for an operator to maximize the efficiency of its system's TT&C operations, and to minimize the constraints placed on other satellite operations.¹⁸

Here, Sirius XM is seeking to use specific frequencies at the upper edges of the conventional C-band spectrum for a limited time during the orbit-raising stage following launch of SXM-9 and SXM-10. During that phase, when the satellites circumnavigate the globe, Sirius XM needs to be able to reliably send commands and receive telemetry signals in order to ensure the safe transit of the spacecraft.

Earlier geostationary Sirius XM satellites relied for TT&C solely on S-band SDARS downlink spectrum at 2320-2345 MHz and uplink spectrum at 7025-7075 MHz. However, Sirius XM experienced significant interference from S-band terrestrial systems during orbit raising of its previous satellites, putting them at risk by impairing Sirius XM's ability to reliably receive telemetry information regarding the satellites' position. Sirius XM seeks to avoid similar interference events by employing conventional C-band spectrum for TT&C during this phase.

¹⁷ 47 C.F.R. § 25.202(g).

¹⁸ *Orbcomm License Corp.*, Order and Authorization, 23 FCC Rcd 4804, 4811 at ¶ 20 (IB & OET 2008).

Sirius XM requested and received a similar waiver allowing it to use C-band TT&C frequencies during orbit raising of SXM-7 and SXM-8,¹⁹ and those satellites were moved to the geostationary arc without incident. The same relief is appropriate here.

Granting this waiver will not undermine the rule's objectives, which include facilitating coordination, avoiding undue constraints on other satellite operations, and ensuring efficient use of spectrum for TT&C. No other party will be harmed by the limited C-band operations. Consistent with industry practice, all TT&C operations during orbit-raising will be coordinated with satellites that use the same frequency bands and are in the orbit-raising path. Operators of U.S. earth stations supporting the orbit-raising maneuvers will need to obtain special temporary authority ("STA") from the Commission, and we expect any such STA grant will authorize operations that will be unprotected and may not cause harmful interference.

Grant of this waiver will also serve the public interest. Using conventional C-band spectrum during the brief but critical orbit-raising phase will improve the reliability of the telemetry data received. Moreover, the requested C-band use will greatly increase the number of earth stations around the globe capable of supporting the orbit-raising process.

As noted above, the Commission has previously waived Section 25.202(g) to allow use of C-band TT&C frequencies during orbit raising of SXM-7 and SXM-8. Moreover, there is other precedent for granting such a waiver based on similar considerations involving international frequency usage and earth station availability. For example, the Commission authorized the use of C-band TT&C spectrum in connection with the legacy Sirius non-geostationary SDARS fleet based on a finding that using C-band frequencies would avoid

¹⁹ See SXM-7 Grant, Attachment to Grant at 2, ¶ 9.

potential interference issues involving terrestrial services outside the U.S.²⁰ The Commission has also waived Section 25.202(g) for transfer orbit operations given the unavailability of service-band earth station facilities around the globe.²¹ Granting a waiver to permit C-band TT&C for SXM-9 and SXM-10 during transfer orbit maneuvers is fully consistent with this precedent.

Section 25.210(j): Section 25.210(j) of the Commission’s rules specifies that geostationary space stations “must be maintained within 0.05° of their assigned orbital longitude in the east/west direction, unless specifically authorized by the Commission to operate with a different longitudinal tolerance.”²² Sirius XM seeks authority for an expanded stationkeeping volume to facilitate flying SXM-9 and SXM-10 in formation with other spacecraft at the 85.15° W.L. and 115.25° W.L. orbital locations. Specifically, at the satellites’ initially planned orbital locations, SXM-9 will be collocated with XM-5 until such time as that satellite is relocated or retired, and SXM-10 will be collocated with XM-3, SXM-8, and SXM-7 until such time as those satellites are relocated or retired.

The Commission has previously waived this rule based on a finding that allowing an increased stationkeeping volume would “not adversely affect the operations of other spacecraft,

²⁰ *Sirius Satellite Radio Inc.*, Order and Authorization, 16 FCC Rcd 5419, 5425 at ¶ 15 (IB 2001) (waiving Section 25.202(g) to allow C-band TT&C “will prevent interference to terrestrial systems in the Southern Hemisphere thereby decreasing the coordination difficulties with countries in the region”).

²¹ See, e.g., *DIRECTV Enterprises, LLC*, Order and Authorization, 21 FCC Rcd 8028, 8035 at ¶ 14 (Sat. Div. 2006) (the lack of available DBS-band TT&C facilities around the world constitutes special circumstances “that warrant a deviation from Section 25.202(g) for the limited purpose of short-term transfer orbit TT&C operations”).

²² 47 C.F.R. § 25.210(j).

and would conserve fuel for future operations.”²³ In addition, the Commission has waived the rule to allow operating multiple space stations in formation within a combined stationkeeping volume.²⁴

The facts here fit squarely within this precedent. Allowing SXM-9 and SXM-10 to operate within an increased stationkeeping volume will not harm other satellite operators. The only satellites with which SXM-9’s or SXM-10’s stationkeeping volume will overlap are other spacecraft in Sirius XM’s own fleet. Sirius XM will ensure that each of its satellites’ flight is closely controlled to ensure the fleet’s safe joint operation. Furthermore, the proposed operations will not materially affect the interference environment.

Finally, allowing SXM-9 and SXM-10 to be flown in formation with other satellites in an east-west stationkeeping volume of +/-0.1 degree facilitates in-orbit sparing for all of the Sirius XM spacecraft at the 85.15° W.L. and 115.25° W.L. orbital locations by allowing faster service restoration on a backup satellite in the event of an issue affecting the primary satellite. Under these circumstances, grant of any necessary waiver of Section 25.210(j) will serve the public interest.

IV. WAIVER PURSUANT TO SECTION 304 OF THE ACT

In accordance with Section 304 of the Communications Act of 1934, as amended, 47 U.S.C. §304, Sirius XM hereby waives any claim to the use of any particular frequency or of

²³ *SES Americom, Inc. Application for Modification of Satcom SN-4 Fixed Satellite Space Station License*, Order and Authorization, 20 FCC Rcd 11542, 11545 (Sat. Div. 2005).

²⁴ *See SES Americom, Inc.*, File No. SAT-MOD-20080314-00072, Call Sign S2135, grant-stamped May 19, 2008 at ¶ 1 (“We agree with SES Americom that increasing the station-keeping volume of the AMC-4 spacecraft will not adversely affect the operations of other spacecraft, will conserve fuel for future operations and will facilitate coordinated operation of AMC-4 and AMC-2 in the same station-keeping range.”).

the electromagnetic spectrum as against the regulatory power of the United States because of the previous use of the same, whether by license or otherwise.

V. CONCLUSION

For the foregoing reasons, Sirius XM hereby respectfully requests that the Commission promptly grant this Application to authorize the launch, operation, and positioning of the SXM-9 and SXM-10 replacement satellites as described herein, allowing Sirius XM to continue to provide to the public the significant benefits of high-quality, reliable SDARS service.

Respectfully submitted,

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ATTACHMENT A

TECHNICAL DESCRIPTION OF SXM-9 AND SXM-10

A.1 GENERAL DESCRIPTION (Section 25.114(d)(1))

Sirius XM Radio Inc. (Sirius XM) and its affiliates XM Radio Inc. (XM Radio) and Satellite CD Radio LLC (Satellite CD) currently operate a network of geostationary orbit Satellite Digital Audio Radio Service (SDARS) satellites, including SXM-8 at 85.15° W.L., FM-5 at 86.15° W.L., XM-5 at 115.25° W.L., and FM-6 at 116.15° W.L. In addition, the XM-3 satellite, which is collocated with SXM-8 at 85.15° W.L., serves as an in-orbit spare to provide backup capacity for XM-5 and SXM-8 in the event of an outage on the primary SDARS spacecraft. The SXM-7 satellite, which is collocated with SXM-8 at 85.15° W.L., also serves as an in-orbit spare to provide limited SDARS backup capacity. This network of satellites provides SDARS in the 2320-2345 MHz band (Space-to-Earth) and receives uplink transmissions in the 7025-7075 MHz band (Earth-to-Space).

Sirius XM is seeking authority to launch and operate two additional satellites, SXM-9 and SXM-10. SXM-9 is intended to serve as a replacement satellite for XM-5, and SXM-10 is intended to provide on-orbit spare capacity as a replacement for XM-3. Sirius XM plans to position SXM-9 at 115.25° W.L. $\pm$ 0.1 degrees, where it will be operated in formation with XM-5 until that satellite is retired or relocated. Sirius XM plans to position SXM-10 at 85.15° W.L. $\pm$ 0.1 degrees, where it will be flown in formation with SXM-8, SXM-7, and XM-3 until those satellites are retired or relocated.

SXM-9 and SXM-10 are identical satellites with the exception of the unique TT&C frequencies described in Table A.3-1, and both satellites can operate at any of the Sirius XM orbit locations: 85.15° W.L., 86.15° W.L., 115.25° W.L., and 116.15° W.L. As further explained in the legal narrative portion of this application, Sirius XM seeks the flexibility to position SXM-9 and SXM-10 at any of the Sirius XM orbital locations as needed to meet SDARS service requirements. A location-specific Schedule S is being submitted for each satellite, reflecting the intended operation

of SXM-9 at 115.25° W.L. ± 0.1 degrees and the intended operation of SXM-10 at 85.15° W.L. ± 0.1 degrees.

The SXM-9 and SXM-10 satellites will provide SDARS to satellite radios located in the contiguous United States (CONUS), Puerto Rico, and Canada.

The SXM-9 and SXM-10 satellites will be capable of operating across the full range of frequencies used by the existing SDARS fleet, 2320-2345 MHz (Space-to-Earth) and 7025-7075 MHz (Earth-to-Space). As noted in the legal narrative, the satellites are also capable of downlinking in the frequencies adjacent to the SDARS band, 2315-2320 MHz (WCS C Block) and 2345-2350 MHz (WCS D Block). Sirius XM is not seeking licensing authority in the WCS C Block and D Block spectrum at this time but has included these bands in its technical materials for the Commission's information. TT&C operations for orbit raising will take place in C-band frequencies, 4196.0-4198.5 MHz (Space-to-Earth) and 6422.0-6425.0 MHz (Earth-to-Space), as discussed in detail in Section A.3. Once the SXM-9 and SXM-10 satellites reach their initial orbital locations, on-station and contingency TT&C operations will take place within the SDARS and feeder link frequency ranges.

A.2 SCHEDULE S

Section 25.114(c)(4)(ii)

The SDARS communication payload beam SD1 has a maximum transmit EIRP density of 8.5 dBW/Hz for operations of SXM-9 at its default orbital location of 115.25° W.L. and 8.3 dBW/Hz for SXM-10 at its default orbital location of 85.15° W.L. At these locations, the satellites will be operated in dual channel mode, with a transmission bandwidth of 1.84 MHz. Because the maximum transmit EIRP density allowed by Schedule S is 0.0 dBW/Hz, Sirius XM has input values of -8.5 and -8.3 dBW/Hz respectively in Schedule S.

If positioned at 86.15° W.L. or 116.15° W.L., the satellites will operate in single channel mode, with a transmission bandwidth of 4.5 MHz. In this mode, the SD1 maximum EIRP will exceed the levels specified in the Schedule S, which represent dual channel mode operation. In single channel mode, the SD1 maximum EIRP is 74.19 dBW for operations at 86.15° W.L. and 74.38 dBW for operations at 116.15° W.L.

Section 25.114(c)(4)(vi)(A)

Pursuant to Section 25.114(c)(4)(vi)(A), the gxt diagrams for the global telecommand receive beam (OSC1), Omni telecommand receive beams (OMC1 and OMX1), and Omni telemetry transmit beams (OMC2 and OMS1) are not included because for each of these beams the contour at 8 dB below peak falls entirely beyond the edge of the visible Earth.

Section 25.114(c)(5)(i)

The online Schedule S automatically rounds the orbital location to a whole number, but the requested orbital location for SXM-9 is 115.25° W.L., and the requested orbital location for SXM-10 is 85.15° W.L.

A.3 TT&C

The telemetry, tracking, and command (TT&C) subsystem provides the satellite communications links for pre-launch, orbit-raising, and on-station operations.

During orbit raising, TT&C operations will be conducted in frequencies on the edges of the conventional C-band to mitigate interference with terrestrial systems using the assigned S-band frequencies outside of North America. Using S-band for TT&C during orbit raising of earlier SDARS satellites, Sirius XM experienced significant interference from terrestrial systems. As was done during the orbit raising for SXM-7 and SXM-8, Sirius XM will follow standard industry procedures to coordinate the use of C-band frequencies. The orbit raising TT&C system is a standard C-band system and incorporates redundant command receivers, telemetry transmitters, and power amplifiers, and uses wide angle C-band antennas for command and telemetry.

Similarly, the on-station and contingency satellite TT&C system is a standard X/S-band system and incorporates redundant command receivers, telemetry transmitters, and power amplifiers. Contingency operations use wide angle X-Band antennas for command and S-band wide angle antennas for telemetry. On-station operations utilize the X-Band global horn for on-station command operation and the S-band broadcast area coverage antenna for telemetry. The nominal TT&C carriers and frequencies are given in Table A.3-1 below and are identified in the Schedule S. However, the X-band command receivers on the satellites are frequency flexible, allowing them to operate at any frequency in the licensed SDARS band of 7025–7075 MHz. Sirius XM seeks flexibility to use that

full range, which will enable Sirius XM to better manage the potential interference between the payload carriers and command carriers for the entire constellation.

Table A.3-1: TT&C Carriers and Frequencies

Parameter	Orbit Raising SXM-9 and SXM-10	On-Station and Contingency SXM-9	On-Station and Contingency SXM-10
Nominal Command/Ranging Frequencies/Polarization	6422.5 MHz (LHCP) 6424.5. MHz (LHCP)	7041.0 MHz (LHCP) 7045.0 MHz (LHCP) 7074.0 MHz (LHCP)	7041.0 MHz (LHCP) 7047.0 MHz (LHCP) 7072.0 MHz (LHCP)
Telemetry/Ranging Frequencies	4196.5 MHz (RHCP) 4197.0 MHz (RHCP)	2324.8 MHz (RHCP) 2328.4 MHz (RHCP) 2327.7 MHz (RHCP) 2343.5MHz (RHCP)	2326.2 MHz (RHCP) 2329.1 MHz (RHCP) 2338.2 MHz (RHCP) 2344.2 MHz (RHCP)

A.4 ORBITAL DEBRIS MITIGATION (Section 25.114(d)(14))

Each section below addresses specific measures taken by Sirius XM, as required under Section 25.114(d)(14) of the Commission’s rules, to limit the possibility that its space station operations will generate orbital debris.

Spacecraft hardware design: Sirius XM and its satellite contractor have assessed and limited the amount of debris that will be released in a planned manner during normal operations of SXM-9 and SXM-10. During the satellites’ ascent, after separation from the launcher, no debris will be generated. All deployments will be conducted using release mechanisms designed to retain all physical debris. No debris will be released by the space stations during normal on-station operations.

Sirius XM has also assessed and limited the probability of the space stations becoming a source of debris by collisions with small debris or meteoroids that could cause loss of control and prevent post-mission disposal. The possibility of collisions with the background environment, including meteoroids, is considered as part of the satellite design on a statistical basis to determine collision risk. Sirius XM’s satellite manufacturer, Maxar, includes meteoroid environments as part of the

satellite Environmental Requirement Specifications. Literature was reviewed for large size space objects, particularly technical papers that present collision probability estimates for orbital conditions of interest. The satellite requirement was derived from these technical papers as well as NASA models to include debris and meteoroids of various sizes. Sirius XM has taken steps to limit the effects of such collisions through shielding, the placement of components, and the use of redundant systems.

Accidental explosions, energy sources on board: Sirius XM has assessed and limited the probability of accidental explosions during and after completion of mission operations. In designing the SXM-9 and SXM-10 satellites, the satellite manufacturer has taken steps to ensure that debris generation will not result from the conversion of energy sources on board the satellite into energy that fragments the satellite. In particular, the satellite manufacturer advises that no structural failures of pressurized volumes have occurred on its satellites to date. Burst tests are performed on all pressure vessels during qualification testing to demonstrate a margin of safety against burst. Bipropellant mixing is prevented by the use of valves that prevent backwards flow in propellant lines and pressurization lines. The lithium ion batteries do not contain any pressure vessels, and Sirius XM will undertake procedures to assure that each battery is discharged at the end of the mission. Pyrotechnics are nominally used in the mission only as part of the initial deployment process. After orbit raising to the disposal orbit, all unfired pyrotechnics will be fired as part of the final satellite decommissioning. Upon reaching the final disposal orbit, all fuel tanks will be close to empty. All remaining propellants and pressurants will be vented utilizing the on-board thrusters.

Collisions with large debris or operational space stations: Sirius XM has assessed and limited the probability of the space station becoming a source of debris by collisions with large debris or other operational space stations. Specifically, Sirius XM has assessed the possibility of collision with satellites located at, or reasonably expected to be located at, the requested orbital locations, or assigned in the vicinity of those locations.

Sirius XM plans to position SXM-9 at 115.25° W.L. +/- 0.1 degrees, where the satellite will be flown in formation with XM-5. XM-5 will subsequently serve as an in orbit-spares until it is retired or relocated.

Sirius XM plans to position SXM-10 at 85.15° W.L. +/- 0.1 degrees, where it will be flown in formation with XM-3, SXM-7 and SXM-8 until those satellites are retired or relocated.

Sirius XM is also seeking the flexibility to position SXM-9 and SXM-10 at either of its other orbital locations, 86.15° W.L. and 116.15° W.L., as needed to meet SDARS service requirements.

As detailed below, Sirius XM has examined whether its station-keeping volume might overlap with that of other operational or planned satellites at the 85.15° W.L., 86.15° W.L., 115.25° W.L., and 116.15° W.L. orbital locations. In addition, Sirius XM has reviewed networks for which a request for coordination has been published by the ITU within ± 0.15 degrees of any of these four orbital positions.

Sirius XM is not aware of any other FCC or non-FCC licensed spacecraft that are operational or planned to be deployed at 115.25°W.L. or to nearby orbital locations such that there would be an overlap with the stationkeeping volume of SXM-9. Moreover, Sirius XM is not aware of any ITU filing for a satellite that is operational or progressing towards launch that is planned to be deployed at the nominal 115° W.L. orbital location such that there would be an overlap with the stationkeeping volume requested for SXM-9. ViaSat, Inc. currently holds Commission authorization to operate ViaSat-1 at 115.1° W.L. with an east-west stationkeeping tolerance of +/- 0.05 degrees, so there will be no overlap of its stationkeeping volume with that of SXM-9. Coordination with ViaSat is not required to assure physical separation, but Sirius XM nonetheless intends to notify ViaSat of Sirius XM's plans to deploy SXM-9 and exchange emergency control center contact data.

Sirius XM is not aware of any other FCC or non-FCC licensed spacecraft that are operational or planned to be deployed at 85.15° W.L. or to nearby orbital locations such that there would be an overlap with the stationkeeping volume of SXM-10. Moreover, Sirius XM is not aware of any ITU filing for a satellite that is operational or progressing towards launch that is planned to be deployed at the nominal 85° W.L. orbital location such that there would be an overlap with the stationkeeping volume requested for SXM-10.

Similarly, Sirius XM is not aware of any other FCC or non-FCC licensed spacecraft that are operational or planned to be deployed at 86.15° W.L. or 116.15° W.L. or to nearby orbital locations such that there would be an overlap with the SXM-9 or SXM-10 stationkeeping volume at one of those locations. Moreover, Sirius XM is not aware of any ITU filing for a satellite that is operational or progressing towards launch that is planned to be deployed at the nominal 86° W.L. or 116° W.L. orbital locations such that there would be an overlap with the stationkeeping volume requested at these locations for SXM-9 or SXM-10.

Post-mission disposal: At the end of the operational life of each spacecraft, Sirius XM will maneuver the SXM-9 and SXM-10 satellites into a disposal orbit with a minimum perigee of 325 km above the normal GSO operational orbit. This proposed disposal orbit altitude is based on the following calculation, as required in Section 25.283:

Total Solar Pressure Area “A” = 128.7 m²

“M” = Dry Mass of Satellite = 2841.2 kg

“C_R” = Solar Pressure Radiation Coefficient (worst case) = 0.945

Therefore the Minimum Disposal Orbit Perigee Altitude:

$$= 36,021 \text{ km} + 1000 \times C_R \times A/M$$

$$= 36,021 \text{ km} + 1000 \times 0.945 \times 128.7/2841.2$$

$$= 36064 \text{ km}$$

$$= 278 \text{ km above GSO (35,786 km)}$$

To provide adequate margin, the nominal disposal orbit will be increased above this calculated value of 278 km to a value of 325 km.

The propulsion subsystem design and the SXM-9 and SXM-10 satellite fuel budgets account for the post-mission disposal of the satellites. Sirius XM will reserve approximately 14 kg of bi-propellant for the de-orbit maneuvers. Sirius XM has assessed fuel-gauging uncertainty and has provided an adequate margin of fuel reserve to address the assessed uncertainty.

A.5 POWER FLUX DENSITY (Section 25.208(a))

Section 25.208(a) specifies the maximum power flux density (PFD) allowed in the C-band frequencies. The maximum PFD levels for SXM-9 and SXM-10 are provided in the Schedule S and do not exceed the limits set forth in Section 25.208(a).

There are no PFD limits in the 2320-2345 MHz downlink frequency band according to the FCC Rules or the ITU Radio Regulations. However, the United States has entered into international coordination agreements which limit the PFD level from the Sirius XM-owned SDARS satellites into Canada and Mexico.¹ SXM-9 and SXM-10 will operate in compliance with the terms of those agreements.

A.6 CONUS COVERAGE (Section 25.144(a)(3)(i))

Files showing the antenna gain contours for SXM-9 and SXM-10 are included with the Schedule S. These files demonstrate that the satellites will provide full-CONUS coverage, as required by Section 25.144(a)(3)(i).

A.7 USER TERMINALS (Section 25.144(a)(3)(ii))

Sirius XM has over 32 million subscribers to its satellite radio service. Most satellite radios are installed in vehicles (including automobiles, trucks, and boats). The deployment of a new generation chipset, already underway in new vehicles, means that by the time SXM-9 and SXM-10 are operational a significant number of vehicles will be capable of receiving signals in both the segment of the SDARS frequency band used by the legacy Sirius-band satellites and the segment used by the legacy XM-band satellites, insuring full interoperable capability across the entire SDARS frequency band.

¹ See Letter from Michael Binder, Assistant Deputy Minister, Spectrum, Information Technologies and Telecommunications, Industry Canada, to Ambassador Vonya B. McCann, U.S. Coordinator and Deputy Assistant Secretary, International Communications and Information Policy, U.S. Department of State (August 25, 1998) (attached to Report No. IN 98-50, *News Release* (Sept. 3, 1998)); Agreement Between the Government of the United States of America and the Government of the United Mexican States Concerning the Use of the 2310-2360 MHz Band (July 24, 2000).

CERTIFICATION OF PERSON RESPONSIBLE FOR PREPARING
ENGINEERING INFORMATION

I hereby certify that I am the technically qualified person responsible for preparation of the engineering information contained in this pleading, that I am familiar with Part 25 of the Commission's rules, that I have either prepared or reviewed the engineering information submitted in this pleading, and that it is complete and accurate to the best of my knowledge and belief.

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